IEA EBC Annex 68 – Subtask 1: Defining the metrics

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1 EXTENDED ABSTRACT

Subtask 1 of IEA EBC Annex 68 will aim at defining the metrics to enable a proper consideration of both energy and IAQ benefit in building design and operation.

A first step will consist in determining a list of target pollutants commonly found in residential buildings by identifying pollutants that are listed by cognizant authorities as harmful and verifying whether they are present in residential environments and at the concentrations, which can surpass the recommendations of the authorities. Since the 1980s, guideline values for pollutants typically found in buildings indoor air have been proposed. Those values are based on comprehensive review and evaluation of accumulated scientific evidence by multidisciplinary groups of experts studying the toxic properties and health effects of these pollutants. The world health organization (WHO, 2010), the European INDEX project (2005) and national health agencies such as ATSDR (USA), ANSES (France)… have proposed guidelines values for chemicals commonly present in indoor air. By considering in-situ measurements in specific indoor environments (dwellings, offices, schools…), target pollutant lists have been established by WHO, INDEX and French IAQ Observatory. Benzene, carbon monoxide, formaldehyde, naphthalene, nitrogen dioxide, PM and PAH are clearly identified as high-priority target pollutants. Biological pollutants such as molds have been considered separately by those studies as no dedicated guideline values are available and will have to be accounted for because of their potential effects on health.

The existing IAQ metrics will then be reviewed to propose the best scientifically-sounded index (or set of indices) for the evaluation of indoor air pollution. According to Sofuoglu and Moschandreas (2003), an index of IAQ must be able to communicate to a non-scientific audience on indoor air pollution levels, must be correlated to the symptoms experienced by the occupants and can be used as a management tool to effectively improve air quality. A literature review of existing indoor environmental quality indices has been recently carried out by the French Observatory of Indoor Air Quality (Kirchner et al., 2006). On the whole, the IAQ indices considered different pollutants, exposure limits and aggregations. As an illustration of the construction and use of such IAQ index, the IAPI (Indoor Air Pollution Index) has been chosen here because it is the only multi-pollutant index of indoor air quality that has been validated to date against health effects. This index, developed by Sofuoglu and Moschandreas (2003), is estimated from the averaged concentration of 8 pollutants: VOCs

(formaldehyde and TVOC), inorganic gases (CO and CO_2), particulate matters (PM2.5 and PM10) and biological particles (bacteria and fungi).

A last part of this subtask will be dedicated to the inclusion of energy in the proposed evaluation. In particular, the index will also have to include additional energy consumption needed to improve IAQ in comparison with standard practice such as increased fan consumption induced by higher air change rates or additional particle/gas filters, or use of portable air cleaners. As an example, Figure 1 presents a comparison of 5 solutions to improve IAQ (Tourreilles, 2015): 3 HVAC air-cleaners and 2 higher ventilation fresh air rates. The metric is defined as the ratio of an IAQ index (0 being bad, 1 being good) to an Energy one (0 being the solution inducing the lowest additional energy consumption). In this example, the electronic filter is clearly the best choice for PM, the "F7+Carbon Filter" and doubling the fresh air rates are equivalent to treat both formaldehyde and PM and the two other solutions induce too high energy consumption.

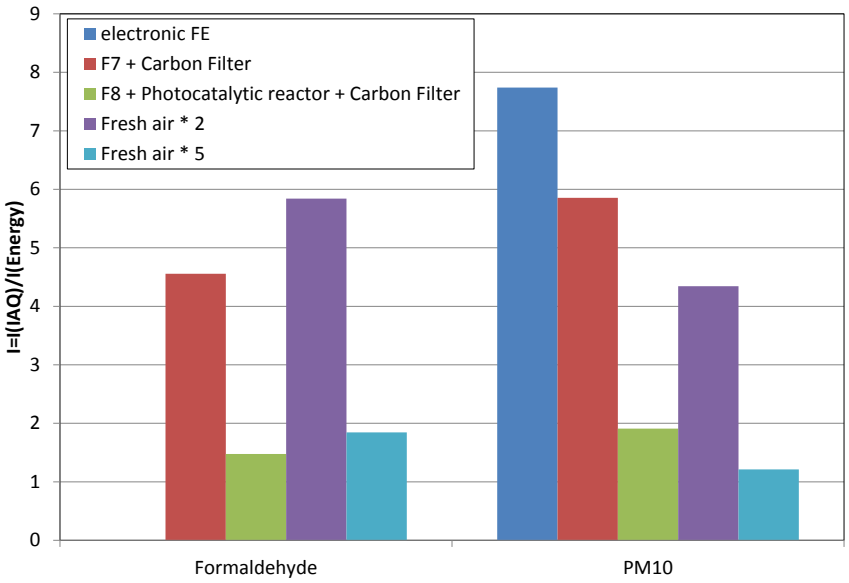

Figure 1: IAQ/Energy impact of 5 solutions proposed to improve IAQ in an office room

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